surface." ~~Id.~~ _Kilgard, p. 1._ Nevertheless, the computations required for original bump mapping techniques proposed by James Blinn in 1978 are considerably more expensive than those required for conventional hardware texture mapping. ~~Id.~~ _Kilgard_ at p. 2.

[0010]   In view of the many attempts that have been made over the last two decades to reformulate bump mapping into a form suitable for hardware implementation, _Kilgard_ proposes a new bump mapping technique. In short, _Kilgard_ divides bump mapping into two steps. First, a perturbed surface normal is computed. Then, a lighting computation is performed using the perturbed surface normal. These two steps must be performed at each and every visible fragment of a bump-mapped surface. ~~Id.~~ _Kilgard._

Summary of the Invention Amendments

Please replace paragraph 12 with the following substitute paragraph:

[0012]   The present invention therefore, provides an ~~apparatus~~ system and method for enhancing the combined image of multiple attributes representing 2-D or 3-D objects. In one embodiment, a first attribute is selected from a source of available attributes and represents one property of the object. A second attribute is selected from the same source of attributes and represents another property of the object. Additional attributes may be selected, depending on the available source of attributes.

Claim Amendments

Please replace original claims 1-47 with the following claims:

1.   (Currently Amended) A method for imaging one or more features of an object, the object comprising multiple attributes, the method comprising the steps of:

a.   selecting a first attribute and a second attribute from the multiple attributes, the first attribute and the second attribute each having its own vertices;

b.   creating a normal map using at least one of the first and second attributes, the normal map having its own vertices;

c.   converting the normal map vertices and the vertices of the at least one of the first and second attributes used to create the normal map into a matrix representing a tangent space normal map;

d.   calculating a diffuse lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map; and

e.   combining an ambient lighting component with the diffuse lighting component and at least one of the first and second attributes to form an image representing a select feature of the object that is substantially indistinguishable in its natural environment.

2.   (Original)   The method of claim 1, wherein at least one of the first attribute and the second attribute comprise a combination of two or more attributes.

3. (Original) The method of claim 2, wherein the combination of two or more attributes form a hybrid attribute.

4. (Original) The method of claim 2, wherein the first attribute comprises any combination of two or more attributes comprising amplitude, frequency, phase, power, semblance, coherency, dip, azimuth, gradient, fluid factor, acoustic impedance, velocity, pressure, porosity, permeability, stratigraphy and lithology and the second attribute comprises at least one attribute from amplitude, frequency, phase, power, semblance, coherency, dip, azimuth, gradient, fluid factor, acoustic impedance, velocity, pressure, porosity, permeability, stratigraphy and lithology.

5. (Original) The method of claim 1, wherein the ambient lighting component and diffuse lighting component are combined with the first attribute and the second attribute is used to create the normal map.

6. (Original) The method of claim 1, wherein the ambient lighting component and the diffuse lighting component are combined with the first attribute and the first attribute is used to create the normal map.

7. (Currently Amended) The method of claim 1, further comprising the steps of:

a. selecting a third attribute, the third attribute having its own vertices;

b. creating another normal map using at least one of the first, second and third attributes, the another normal map having its own vertices;

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c. converting the another normal map vertices and the vertices of the at least one of the first, second and third attributes used to create the another normal map into another matrix representing another tangent space normal map;

d. calculating another diffuse lighting component from the another tangent space normal map and the at least one of the first, second and third attributes used to create the another normal map; and

e. combining the ambient lighting component with the another diffuse lighting component and at least one of the first, second and third attributes to form another image representing a select feature of the object.

8. (Original) The method of claim 7, wherein the third attribute comprises the combination of the ambient lighting component, the diffuse lighting component and the at least one of the first and second attributes.

9. (Original) The method of claim 8, wherein the another normal map is created using at least one of the first and second attributes and the third attribute is combined with the ambient lighting component and the another diffuse lighting component to form the another image.

10. (Original) The method of claim 8, wherein the another normal map is created using the third attribute and the third attribute is combined with the ambient lighting component and the another diffuse lighting component to form the another image.

11. (Original) The method of claim 1, further comprising the step of displaying at least a portion of the image to a user.

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12.   (Original)   The method of claim 11, wherein the image displayed is displayed on at least a portion of one of a plurality of planar surfaces defining a probe.

13.   (Original)   The method of claim 11, wherein the image displayed is displayed at least partially within a plurality of planar surfaces defining a probe.

14.   (Currently Amended) The method of claim 1, wherein the first attribute and the second attribute each comprise multiple data values and associated spatial coordinates, each data value having a three-dimensional spatial coordinate (x, y, z).

15.   (Original)   The method of claim 14, wherein the normal map comprises multiple perturbed normal vectors that are derived from the cross product of a vertical component and a horizontal component for each data value.

16.   (Original)   The method of claim 1, wherein a vertex program is used to convert the normal map vertices and the vertices of the at least one of the first and second attributes used to create the normal map into the matrix representing the tangent space normal map.

17.   (Original)   The method of claim 1, wherein the diffuse lighting component and the ambient lighting component are each calculated using a register combiner.

18.   (Original)   The method of claim 17, wherein the ambient lighting component, the diffuse lighting component and the at least one of the first and second attributes are combined using the register combiners to form the image.

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19. (Original) The method of claim 1, wherein the first attribute and the second attribute comprise medical data.

20. (Original) The method of claim 1, wherein the first attribute and the second attribute comprise seismic data.

21. (Original) The method of claim 1, wherein the ambient lighting component is a predetermined constant.

22. (Currently Amended) The method of claim 1, further comprising the steps of:

a. calculating a specular lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map; and

b. combining the specular lighting component, the ambient lighting component, the diffuse lighting component and the at least one of the first and second attributes to form the image.

23. (Currently Amended) The method of claim 1, further comprising the steps of:

a. applying an imaginary light source to the image;

b. displaying a portion of the image to a user;

c. interactively repositioning at least one of the imaginary light source and the displayed image relative to a line of sight of the displayed image to the user; and

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d.   ~~repeating steps c, d and e in claim 1.~~ repeating the last three steps in claim 1.

24.   (Currently Amended) A method for imaging ~~one or more~~a select feature~~s~~ of an object_that is substantially indistinguishable in its natural environment, the object comprising multiple attributes, the method comprising the steps of:

a.   selecting an attribute from the multiple attributes, the attribute having its own vertices;

b.   creating a normal map using the attribute, the normal map having its own vertices;

c.   converting the normal map vertices and the vertices of the attribute into a matrix representing a tangent space normal map;

d.   calculating a diffuse lighting component from the tangent space normal map and the attribute; and

e.   combining an ambient lighting component with the diffuse lighting component and the attribute to form an image representing a-the select feature of the object. ~~that is substantially indistinguishable in its natural environment.~~

25.   (Currently Amended) A method for imaging one or more features of an object, the object comprising multiple attributes, the method comprising the steps of:

a.   selecting a first attribute and a second attribute from the multiple attributes, the first attribute and the second attribute each having its own vertices;

b.   creating a normal map using at least one of the first and second attributes, the normal map having its own vertices;

c. converting the normal map vertices and the vertices of the at least one of the first and second attributes used to create the normal map into a matrix representing a tangent space normal map;

d. calculating a diffuse lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map;

e. combining an ambient lighting component with the diffuse lighting component and at least one of the first and second attributes to form an image representing a select feature of the object; and

f. displaying at least a portion of the image to a user, the portion of the displayed image comprising at least part of the first attribute and part of the second attribute.

26. (Original) The method of Claim 25, wherein the select feature of the object is substantially indistinguishable in its natural environment.

27. (Currently Amended) A system comprising a program storage device readable by a machine, the storage device embodying a program of instructions executable by the machine for imaging one or more features of an object, the object comprising multiple attributes, the system instructions comprising the steps of:

a. selecting a first attribute and a second attribute from the multiple attributes, the first attribute and the second attribute each having its own vertices;

b. creating a normal map derived from at least one of the first and second attributes, the normal map having its own vertices;

c. ~~a means for~~ converting the normal map vertices and the vertices of the at least one of the first and second attributes used to create the normal map into a matrix representing a tangent space normal map;

d. ~~a means for~~ calculating a diffuse lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map; and

e. ~~a means for~~ combining an ambient lighting component with the diffuse lighting component and at least one of the first and second attributes to form an image representing a select feature of the object that is substantially indistinguishable in its natural environment.

28. (Original) The system of claim 27, wherein at least one of the first attribute and the second attribute comprise a combination of two or more attributes.

29. (Original) The system of claim 28, wherein the combination of two or more attributes form a hybrid attribute.

30. (Original) The system of claim 28, wherein the first attribute comprises any combination of two or more attributes comprising amplitude, frequency, phase, power, semblance, coherency, dip, azimuth, gradient, fluid factor, acoustic impedance, velocity, pressure, porosity, permeability, stratigraphy and lithology and the second attribute comprises at least one attribute from amplitude, frequency, phase, power, semblance, coherency, dip, azimuth, gradient, fluid factor, acoustic impedance, velocity, pressure, porosity, permeability, stratigraphy and lithology.

31. (Original) The system of claim 27, wherein the ambient lighting component and the diffuse lighting component are combined with the first attribute and the second attribute is used to create the normal map.

32. (Original) The system of claim 27, wherein the ambient lighting component and the diffuse lighting component are combined with the first attribute and the first attribute is used to create the normal map.

33. (Currently Amended) The system of claim 27, further comprising the steps of:

a. ~~a.~~ selecting a third attribute, the third attribute having its own vertices;

b. ~~b.~~ creating another normal map derived from at least one of the first, second and third attributes, the another normal map having its own vertices;

c. ~~c.~~ ~~a means for~~ converting the another normal map vertices and the vertices of the at least one of the first, second and third attributes used to create the another normal map into another matrix representing another tangent space normal map;

d. ~~d.~~ ~~a means for~~ calculating a diffuse lighting component from the another tangent space normal map and the at least one of the first, second and third attributes used to create the another normal map; and

e. ~~e.~~ ~~a means for~~ combining the ambient lighting component with the another diffuse lighting component and at least one of the first, second and third attributes to form another image representing a select feature of the object.

34.   (Original)   The system of claim 33, wherein the third attribute comprises the combination of the ambient lighting component, the diffuse lighting component and the at least one of the first and second attributes.

35.   (Original)   The system of claim 34, wherein the another normal map is created using at least one of the first and second attributes and the third attribute is combined with the ambient lighting component and the another diffuse lighting component to form the another image.

36.   (Original)   The system of claim 34, wherein the another normal map is created using the third attribute and the third attribute is combined with the ambient lighting component and the another diffuse lighting component to form the another image.

37.   (Currently Amended) The system of claim 27, further comprising the step of displaying at least a portion of the image on a monitor ~~a monitor, the monitor displaying at least a portion of the image~~ to a user.

38.   (Currently Amended) The system of claim 27, wherein the first attribute and the second attribute each comprise multiple data values and ~~associated~~ corresponding spatial coordinates, each data value having a three-dimensional spatial coordinate ~~(x,y,z)~~.

39.   (Original)   The system of claim 38, wherein the normal map comprises multiple perturbed normal vectors that are derived from the cross product of a vertical component and a horizontal component for each data value.

40.   (Original)   The system of claim 27, wherein the first attribute and the second attribute comprise medical data.

41. (Original) The system of claim 27, wherein the first attribute and the second attribute comprise seismic data.

42. (Original) The system of claim 27, wherein the ambient lighting component is a predetermined constant.

43. (Currently Amended) The system of claim 27, further comprising the steps of:

 a. ~~a means for~~ calculating a specular lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map; and

 b. ~~a means for~~ combining the specular lighting component, the ambient lighting component, the diffuse lighting component and the at least one of the first and second attributes to form the image.

44. (Currently Amended) The system of claim 27, further comprising the steps of:

 a. applying an imaginary light source ~~that is applied~~ to the image;

 b. ~~a monitor for~~ displaying a portion of the image to a user; ~~and~~

 c. ~~a means for~~ interactively repositioning at least one of the imaginary light source and the displayed image relative to a line of sight of the displayed image to the user; and

 repeating the last three steps in claim 27.~~.~~

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45. (Currently Amended) A system comprising a program storage device readable by a machine, the storage device embodying a program of instructions executable by the machine for imaging a select ~~one or more~~ features of an object that is substantially indistinguishable in its natural environment, the object comprising multiple attributes, the ~~system~~ instructions comprising the steps of:

a. selecting an attribute from the multiple attributes, the attribute having its own vertices;

b. creating a normal map derived from the attribute, the normal map having its own vertices;

c. ~~a means for~~ converting the normal map vertices and the vertices of the attribute into a matrix representing a tangent space normal map;

d. ~~a means for~~ calculating a diffuse lighting component from the tangent space normal map and the attribute; and

e. ~~a means for~~ combining an ambient lighting component with the diffuse lighting component and the attribute to form an image representing the ~~a~~ select feature of the object. ~~that is substantially indistinguishable in its natural environment.~~

46. (Currently Amended) A system comprising a program storage device readable by a machine, the storage device embodying a program of instructions executable by the machine for imaging one or more features of an object, the object comprising multiple attributes, the ~~system~~ instructions comprising the steps of:

a. selecting a first attribute and a second attribute from the multiple attributes, the first attribute and the second attribute each having its own vertices;

b. ~~b.~~ <u>creating</u> a normal map derived from at least one of the first and second attributes, the normal map having its own vertices;

~~c.~~ ~~a means for~~ converting the normal map vertices and the vertices of at least one of the first and second attributes used to create the normal map into a matrix representing a tangent space normal map;

~~d.~~ ~~a means for~~ calculating a diffuse lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map;

~~e.~~ ~~a means for~~ combining an ambient lighting component with the diffuse lighting component and at least one of the first and second attributes to form an image representing a select feature of the object; and

~~f.~~ ~~a monitor for~~ displaying at least a portion of the image to a user, the portion of the displayed image comprising at least part of the first attribute and part of the second attribute.

47. (Currently Amended) ~~An image representing~~ <u>A computer data signal embodied in a transmission medium comprising an image representing</u> a select feature of an object, the object comprising multiple attributes, the image comprising a first attribute and a second attribute <u>selected from the multiple attributes,</u> ~~and~~ at least a portion of the image being visible to a user, the portion of the visible image comprising at least part of the first attribute and part of the second attribute<u>.</u> ~~, the at least part of the first attribute and part of the second attribute also being simultaneously visible to the user.~~

48.   (New) A computer data signal embodied in a transmission medium comprising an image representing a select feature of an object that is substantially indistinguishable in its natural environment, the object comprising multiple attributes, the image comprising an attribute selected from the multiple attributes, at least a portion of the image being visible to a user.

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Remarks

Claims 1-48 are now presented in this application for consideration on the merits.

Claims 1, 7, 14, 22, 23, 24, 25, 27, 33, 37, 38, and 43-47 have been amended. Claim 48 is new.

Paragraphs 9, 10 and 12 of the specification have been replaced.

No new matter is introduced into this application by way of these amendments.

Accordingly, early and favorable consideration of the claims on the merits is requested.

The Commissioner is hereby authorized to charge any amount required to Deposit

Account No. 19-2112.

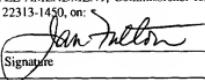Respectfully submitted,

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